

REMARKS

In an Office Action dated May 28, 2004, the Examiner rejects all of the pending claims as being obvious over various relied upon references. Applicant respectfully disagrees with the Examiner's holding and, in response, submits the present Remarks which demonstrate the non-obviousness of the claimed invention. The Examiner's particular rejections are now addressed in turn.

Claims 1, 2, 5, 7, 8, 10, 11, 15-17, 21, and 22 are rejected under 35 U.S.C. §103(a) as being obvious in view of U.S. Patent No. 4,801,477 to Fudim. Applicant notes that the Examiner's citation of the Berlin reference in the second line of item no. 2 of the Office Action constitutes a typographical error as the outstanding rejection is based upon Fudim alone. Essentially, the Examiner asserts that Fudim discloses all of the limitations of the rejected claims except for the recited provisions concerning 'at least two spatial light modulators of individually controllable light modulators'. The Examiner contends that this claim limitation merely constitutes a duplication of a part for a multiple effect, i.e., the claim limitation uses multiple light modulators so as to affect a greater area. The Examiner thus contends that it would have been obvious for one of skill in the art to modify Fudim to contain multiple light modulators to thus provide an increase in coverage area of the Fudim device.

In response, Applicant respectfully submits that *prima facie* obviousness does not exist with respect to the Examiner's proposed modification of the Fudim reference and thus the outstanding §103 rejection is not proper and may not be maintained.

Turning first to independent claim 1, a rapid prototyping apparatus is recited for manufacturing three-dimensional objects of light sensitive material, the apparatus comprising, *inter alia*, a light source, a least two spatial light modulators of individually controllable light modulators, and a plurality of light guides optically coupled to the source and arranged with respect to the spatial light modulators such that each light guide illuminates a sub-area of a cross section.

As mentioned above, the Examiner concedes that Fudim does not teach the plurality of spatial light modulators recited in claim 1. However, the Examiner contends that the reference *suggests* this claim limitation because it merely constitutes a duplication of a part for a multiple effect. The mere duplication of parts has been held to have no patentable significance *unless* a new and unexpected result is produced. *In re Harza*, 274 F.2d 669, 124 USPQ 378 (CCPA 1960). As will be shown, Applicant's claimed invention indeed provides a new and unexpected result. Thus, Fudim does not teach or even suggest the invention of claim 1. Accordingly, *prima facie* obviousness is not established.

The invention of claim 1 advantageously distributes the light from a single source to a plurality of sub-areas by use of at least two spatial light modulators. This constitutes a vast improvement over the state of the art, represented by Fudim, which employs one light source per spatial light modulator. It is well known that the material used in rapid

prototyping processes is highly light sensitive. It is also known that the illumination characteristics of the light source employed in such processes often varies significantly and unpredictably during the initial start-up and over time. Thus, prior art systems which utilize a plurality of spatial light modulators and a corresponding plurality of light sources require a high degree of monitoring and control to ensure that consistent illumination is provided by the light sources. Where one light source degenerates at a different rate than a neighboring source, hardening errors and inconsistencies may occur in the light sensitive material. For example, in one sub-area the 'vertical' illumination may be insufficient to provide a joining to the underlayer whereas in an adjacent sub-area a proper connection to the underlayer may be established. Additionally, where one of the plurality of prior art light sources degenerates at a different rate than the others, *all* of the light sources must be replaced in attempt to provide homogenous illumination. These deficiencies of the prior art are addressed in the specification at least at page 2, lines 21-30 and page 3, lines 23-30.

The apparatus of claim 1 comprises a light source shared by a *plurality* of spatial light modulators. This arrangement overcomes the problems of the prior art by allowing multiple sub-areas of the light sensitive material to be subjected to illumination from one light source. Thus, the illumination provided by the claimed invention is *homogenous* across a plurality of illuminated sub-areas at start-up and throughout the scanning process. The illumination may be varied or compensated as desired during use and degeneration of the light source by a simple modification of the single light source. An operator is not required to monitor and adjust multiple light sources, as in the prior art. The result is a

rapid prototyping apparatus which is easy to operate and which results in consistent, predictable, and easily controllable rapid prototyping of a light sensitive material.

The use of “at least two spatial light modulators” in claim 1 does not constitute a mere duplication of a part for a multiple effect, as contended by the Examiner. To the contrary, a new and unexpected result is provided in that the problems associated with one-light-source-per-light-modulator systems (like Fudim) are substantially overcome, as discussed above. Thus, the claim limitation has “patentable significance”. *In re Harza*, 274 F.2d 669, 124 USPQ 378 (CCPA 1960).

Applicant notes that to establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally the prior art reference(s) must teach or suggest all the claim limitations. *In re Fine*, 5 U.S.P.Q.2d 1596, 1598 (Fed. Cir. 1988); *In Re Wilson*, 165 U.S.P.Q. 494, 496 (C.C.P.A. 1970); *Amgen v. Chugai Pharmaceuticals Co.*, 927 U.S.P.Q.2d 1016, 1023 (Fed. Cir. 1996).

As conceded by the Examiner, Fudim fails to teach “at least two spatial light modulators” as recited in claim 1. Moreover, the reference does not *suggest* this limitation because, as discussed above, this limitation provides a new and unexpected result not found or addressed in Fudim.

Additionally, there is no suggestion or motivation, in Fudim or in the knowledge available in the art, to modify the teaching of Fudim as proposed by the Examiner. In the Office Action, the Examiner states that one of skill in the art would have been motivated to modify Fudim as proposed to allow for an increase in coverage area. However, Figure 4 of Fudim shows an embodiment of the disclosed apparatus including a radiation emitting surface 15 having a larger size, up to the full cross-sectional area of the object to be formed. Col. 4, lines 42-50. Thus, Fudim suggests increasing coverage area by increasing the size of the radiation emitting surface NOT by multiplying the number of light sources and the corresponding number of spatial light modulators. Nowhere in the reference does Fudim discuss or allude to the use of a plurality of light sources and a corresponding plurality of spatial light modulators in order to increase the area of coverage. Accordingly, there is no suggestion or motivation found in Fudim, or elsewhere, to modify the reference to form the invention of Applicant's claim 1.

Also, since Fudim does not teach or suggest all of the limitations of claim 1 and since there is no suggestion or motivation to modify Fudim, then, clearly, there is no likelihood of success of forming the claimed invention through modification of Fudim.

For at least these reasons, none of the requirements for *prima facie* obviousness are met with respect to the Examiner's proposed modification of Fudim. Accordingly, the outstanding §103 rejection of claim 1 is improper; reconsideration and withdrawal thereof is respectfully requested.

Claim 2, 5, 7, 8, 10, 11, and 21 are also rejected as being obvious in view of Fudim. However, these claims variously depend from nonobvious claim 1 and are thus correspondingly nonobvious; reconsideration and withdrawal of the relevant rejections is respectfully requested.

As mentioned above, independent claim 15 is also rejected under §103(a) as being obvious in view of Fudim. Claim 15 recites a method of manufacturing three dimensional objects by means of a rapid prototyping apparatus which, similar to the apparatus of claim 1, comprises “at least one light source illuminating a cross section of the material by at least two modulator arrangements...” Thus, for at least the reasons expressed above concerning claim 1, the requirements for prima facie obviousness of claim 15 are not met with respect to the Fudim reference; reconsideration and withdrawal of the rejection of claim 15 is respectfully requested.

Claims 16 and 17 are also rejected as obvious in view of Fudim. These claims depend from nonobvious claim 15 and are thus correspondingly nonobvious; reconsideration and withdrawal of the rejections is requested.

Independent claim 22 is also rejected under §103 as being obvious in view of the Examiner’s proposed modification of Fudim. However, as will now be shown, Fudim fails to teach or suggest all of the limitations of claim 22, therefore the claim is not *prima facie* obvious in view of the reference.

Specifically, Fudim does not teach or suggest a rapid prototyping apparatus “wherein the plurality of light guides is disposed *between* the light source and the spatial light modulators”, as recited in claim 22 (emphasis added).

Figure 4 of Fudim illustrates a container 10 for holding an uncured polymer 11, a substrate 12 disposed in the container 10, and a guide 13 located in the polymer 11 above the substrate 12. The guide 13 contains a fused bundle of optical fibers 14. The guide 13 is sealed at a lower surface by a radiation emitting surface 15 and at an upper surface by a changeable mask or aperture 20. The mask or aperture 20 includes different areas of opacities. Finally, a radiation source 18 which emits light is disposed above the mask or aperture 20. In use, the Fudim device emits light from the radiation source 18 incident upon the mask or aperture 20 which varies the opacity thereof, thus modulating the light. Then, the modulated light radiates upon the bundle of optical fibers in the guide 13 and is delivered therethrough to the radiating surface 15 and emitted therefrom into the uncured polymer 11 of the container 10.

Thus, the light modulator of Fudim (the mask 20) is disposed between the light source (radiation source 18) and the light guides (optical fibers 14). Fudim does not teach or even suggest “light guides disposed between the light source and the spatial light modulators” as recited in claim 22.

Accordingly, Fudim does not teach or suggest all of the limitations of claim 22. Thus, for at least this reason, claim 22 is not *prima facie* obvious in view of Fudim; reconsideration and withdrawal of the relevant rejection is requested.

Independent claims 1, 15, and 22 are not further rejected or objected to and are thus correspondingly allowable to Applicant.

Claim 3, 4, 6, 9, 13, and 14 are rejected under 35 U.S.C. §103(a) as being obvious in view of Fudim as combined with U.S. Patent No. 4,929,402 to Hull. All of these claims variously depend from allowable independent claim 1. Thus, claims 3, 4, 6, 9, 13, and 14 are allowable; withdrawal of the rejections is requested.

Claims 12 and 18 are rejected under §103 as being obvious in view of Fudim as combined with U.S. Patent No. 5,593,531 to Penn. Again, these claims variously depend from allowable claim 1 and are thus correspondingly allowable. Reconsideration and withdrawal of the rejections is requested.

Finally, claim 20 is rejected as being obvious under §103 in view of Fudim as combined with Hull and U.S. Patent No. 6,051,179 to Hagenau. Claim 20 depends from allowable claim 1 and is thus allowable; withdrawal of the rejection is requested.

Accordingly, all pending claims 1-18 and 20-22 are now in condition for allowance. Reconsideration and withdrawal of all outstanding rejections and prompt issuance of a Notice of Allowance are respectfully requested.

No new matter is entered by these Remarks and no new issues for consideration are presented; the claimed invention is merely described and clarified. Thus no additional search is required by the Examiner.


The Examiner is invited to contact Applicant's attorney at the below-listed phone number regarding this Response or otherwise concerning the present application.

Applicant hereby petitions under 37 C.F.R. §1.136 for any extension of time necessary for consideration of the present Reply.

If there are any charges due with respect to this Amendment or otherwise, please charge them to Deposit Account No. 06-1130 maintained by Applicant's attorneys.

Respectfully submitted,

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